National Aeronautics and
Space Administration

Principal Center for Clean Air Act Regulations

CAAWG REGULATORY ALERT

National Academy of Sciences Report May Affect Regulatory Standards for Trichloroethylene

This information is provided as a service of NASA's Clean Air Act Principal Center to inform you of regulatory developments. If you have further questions and/or need assistance with this matter, please contact Sharon Scroggins/MSFC (256.544.7932, sharon.scroggins@nasa.gov).

Introduction

The National Academy of Sciences (NAS) released a report reviewing the health risks associated with trichloroethylene (TCE), on July 27, 2006. The NAS report concluded that evidence of the carcinogenic risk and other potential health hazards from exposure to TCE has strengthened since EPA released its toxicological assessment of TCE in 2001. The report also encourages federal agencies to finalize the risk assessment for TCE using currently available information, allowing risk-management decisions to be expedited. Although the NAS report does not directly propose new regulatory standards or advisory levels for TCE, it may resolve some of the uncertainty about the scientific basis for those standards and the timing for their implementation. The recommendations from the NAS report could affect the cleanup levels for hundreds of sites across the United States where TCE has been detected in soil and groundwater.

Background

Beginning in the mid-1920s, TCE was used as a cleaning and degreasing solvent in a wide range of industries, a refrigerant, an anesthetic gas, and an ingredient in numerous products. Production and use of TCE peaked in 1970 and has declined since then, in part because of the tightening of environmental and occupational health and safety standards and the availability of safer substitutes.

TCE was first detected in groundwater in 1977, and is now one of the most frequently detected groundwater contaminants in the United States. As much as 34% of the drinking water supply sources tested around the country may have some TCE contamination, although EPA has reported that most water supplies are in compliance with the maximum contaminant level (MCL) of 5 µg/L. In addition, vapor intrusion in buildings, which has resulted in indoor air exposures, has become a growing concern in recent years at sites with soil or groundwater TCE contamination.

In 2001, EPA issued a draft reassessment of the health risks associated with TCE. This report concluded that TCE posed a more significant human health risk than previous studies had indicated. It provoked considerable debate about the quality of evidence describing the health risks of TCE, and the methods used to assess that evidence. In 2004, an interagency group composed of the EPA, the Department of Defense (DoD), the Department of Energy

(DOE), and NASA requested that the NAS provide independent guidance on the scientific issues related to TCE health risks.

How the NAS Report Might Affect TCE Cleanup Levels

Once the recommendations in the NAS report are implemented, new regulatory drivers for TCE cleanups may emerge in the near future. Some key findings from the NAS report that may eventually influence cleanup levels and the drinking water standard for TCE follow:

• The evidence on the carcinogenic risk and other potential health hazards from exposure to TCE has strengthened since 2001 (since EPA published its reassessment of TCE health risks).

• The NAS recommends that federal agencies finalize the TCE risk assessment with currently available data "so that risk management decisions can be made expeditiously."

• The NAS committee noted a strong correlation between TCE and kidney cancer in humans. In addition, they expressed concerns about reproductive and developmental health problems, such as congenital heart defects, potentially associated with TCE exposure.

• The NAS appears to have accepted the EPA's recommendation that sensitive populations should be addressed in developing health-based standards for TCE. Characteristics defining sensitive populations could include conditions such as obesity and diabetes.

• NAS concluded that the currently available epidemiological (human) data were inadequate to support quantitative risk assessment for TCE. Epidemiological studies were used to develop the cancer slope factors (toxicity values) EPA recommended in 2001. Many EPA regions have since used these slope factors to develop risk-based concentrations. As a result, the NAS committee's conclusion potentially raises questions about the scientific basis underlying the risk-based concentrations developed by various EPA regions.[1]

• In addition, the cancer slope factors recommended in EPA's 2001 reassessment treated cancer risk from TCE as a linear "non-threshold" event (meaning that the only risk-free dose is zero). Agencies often use this conservative approach to protect public health when there is uncertainty about the actual risks at low levels of exposure. The NAS recommended a more refined approach to quantitatively assessing TCE cancer risks. The recommended approach includes making greater use of nonlinear models along with linear models for estimating risks from low-level exposures.

Although the NAS report addressed many of the scientific questions about TCE health risks, the NAS committee was not charged with recommending cleanup standards. Such standards will require that EPA complete a revised risk assessment incorporating the NAS report's findings and recommendations. At this time, it is difficult to predict whether regulatory standards will become more or less stringent once this revised risk assessment is complete. In the interim, however, some states have independently produced risk assessments containing information useful for guiding TCE investigation and cleanup efforts.

[1] Risk-based concentrations such as Preliminary Remediation Goals (PRGs) have been calculated using a cancer slope factor that was based on an epidemiological study presented in EPA's 2001 TCE reassessment.

State Agencies Take Action

The California Environmental Protection Agency (Cal-EPA) and the Indiana Department of Environmental Management (IDEM) have moved ahead in independently developing the scientific basis for cleanup levels for TCE. Cal-EPA published cancer slope factors (toxicity values) in 1999, and the U.S. Air Force has recommended that these values be used to assess health risks and develop cleanup levels for TCE until EPA's reassessment of TCE is complete. In 2005, IDEM developed evaluation criteria for selecting an appropriate study from the range of studies in EPA's 2001 reassessment for use in deriving a cancer slope factor. The cancer slope factors these agencies developed are less conservative than those presented in the 2001 reassessment, and correspondingly yield higher cleanup levels.

Congress and Legislatures Get Involved

Members of the public have expressed significant concerns about drinking water contamination and vapor intrusion associated with TCE in their communities. These concerns have translated into heightened awareness about TCE among state legislators and congressional representatives. In October 2005, seven U.S. senators sent a letter to EPA Administrator Steven L. Johnson, requesting that EPA develop "interim standards" to protect the public from TCE vapor intrusion. The New York State Assembly published a study in January 2006 that highlights vapor intrusion as an emerging public health concern and calls for state agencies to strengthen standards. After the NAS report was released, Congressman Maurice Hinchey (D-NY) issued a statement strongly encouraging the EPA to produce a final TCE risk assessment within a year.

As yet, the political activities generally have not included legislation to force action on TCE contamination. The appropriations bill for the Department of Defense in 2007 (S.B. 2766), however, introduced this year by Senator John Warner (R-VA), contains a requirement for the NAS to conduct a study of human exposures to TCE in drinking water at Camp Lejeune, North Carolina.

Remediation Approaches

TCE contamination of groundwater and subsurface soil is potentially a problem at thousands of sites across the country. Many of these sites represent a threat to groundwater resources. In areas where the groundwater resources are not considered at risk, there are frequently impediments to the reuse of "brownfield" sites. The presence of dense nonaqueous phase liquids (DNAPL) poses unique remediation challenges at some of these sites. In addition, for many subsurface geological settings, conventional treatment methods—such as pump-and-treat technology—can be costly and inefficient. Emerging in-situ groundwater and subsurface soil treatment technologies, including in-situ chemical oxidation, in-situ biodegradation, permeable reactive barriers, and enhanced soil vapor extraction or air-sparging methods, combined with monitored natural attenuation, may provide effective lower-cost alternatives for the cleanup of TCE in soil and groundwater.

Impact on NASA

Many NASA Centers and contractors have used TCE for cleaning operations such as degreasing. Operations in which TCE was used include but are not limited to:

- LOX tube/pipe cleaning operations to achieve the "LOX clean" standard
- Rocket Propellant 1 (RP-1)/LOX engine cleaning for scale model and full scale engine testing
- RP-1/LOX engine turbopump cleaning
- General cleaning operations involving oil/grease removal
- Vapor degreaser operations
- Parts cleaning prior to paint applications
- Waste and product storage areas
- Burial sites and burn pits

TCE is a breakdown product of tetrachloroethylene (also known as perchloroethylene, "perc" or PCE) when released to the environment, if the subsurface conditions are favorable for reductive dechlorination processes to occur. Therefore, if PCE has been released to the environment, a resulting TCE plume can result due to natural attenuation processes on-going in the subsurface soil and groundwater.

TCE cleanup operations are underway at several NASA Centers. Changes in TCE cleanup levels could have an impact on NASA site decision making related to:

- Existing Records of Decision,
- Pump and treat and soil vapor extraction systems currently in operation,
- In-situ subsurface soil and groundwater treatment technology standards, and
- The vapor intrusion migration pathway to indoor air.

The Clean Air Act Principal Center can provide assistance in interpreting the ever-changing regulatory framework associated with TCE.